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ALTITUDINAL MIGRATION OF CENTRAL CALIFORNIA BUTTERFLIES

ARTHUR M. SHAPIRO

Department of Zoology, University of California, Davis 95616

BUTTERFLY SPECIES WHICH ARE NOT MASS MIGRANTS in the sense of the Monarch (*Danaus plexippus* L., Danaidae) or the Painted Lady (*Cynthia cardui* L., Nymphalidae) nonetheless are often recorded as "strays" far beyond their usual ranges. Such "strays" may be geographic or altitudinal. The occurrence of individual "strays" could reflect active or passive dispersal which could be density-related or not. In a previous paper (Shapiro, 1974b) data were presented on lowland California butterflies collected at 5000 and 7000 feet above sea level in the central Sierra Nevada in 1972. It was noted that several of the species displaying altitudinal dispersal in California are well-known northward dispersers on the Atlantic coastal plain in the eastern United States. Regular collections of butterflies and skippers were made at Donner Pass, Placer County, California, elevation approximately 7000 feet, from 27 June to 16 October 1973, and from 31 May to 16 October 1974. In the course of this work, several additional records of altitudinal dispersal were obtained, as reported below. In all of these cases, the insects appear to have dispersed upslope. In addition, some evidence suggesting downslope dispersal by one species, *Nymphalis milberti* Latreille (Nymphalidae), is presented.

Donner Pass Records

Donner Pass is well documented, thanks to assiduous collecting by Emmel and Emmel (1962a, b; 1963a, b; 1974) and appears to have the richest butterfly fauna of any investigated montane area in temperate North America of comparable size—about 100 species in a four-square-mile area. The geography and vegetation of Donner Pass are discussed by Emmel and

Emmel (1962a), who note that part of its richness stems from the mixture and overlap of east-slope (Great Basin) and west-slope (Californian) biotic elements. In evaluating the significance of altitudinal dispersal at Donner, it is often difficult—or impossible—to decide whether the immigrants are from the east or west slope. The descent to the lowlands is much more precipitous on the east slope, which is also less heavily forested, so that dispersal (especially if aided by thermals) may be much more rapid from the east.

The records which follow do not exhaust the list of potential dispersers: only especially striking examples are enumerated. LYCAENIDAE: *Brephidium exilis* Boisduval. A female Pygmy Blue in good condition was taken 5 October 1973 feeding on the flowers of *Chrysothamnus nauseosus* (Pall.) Brit. (Compositae) about 1000 feet east of Norden. *B. exilis* occurs abundantly on the floor of the Sacramento Valley at the western base of the Sierras, and has been taken up to about 2800 feet in the foothills in El Dorado County and at 4600 feet in Nevada County. It is also common on the Great Basin floor east of Sierraville in late summer and in desert conditions near Reno, Nevada. Colonization could thus occur from either side of the mountains. Among potential hosts of *B. exilis* (Shapiro, 1973) only the introduced weed *Salsola kali* L. var. *tenuifolia* Tausch. (Chenopodiaceae) occurs at Norden, along with two other undetermined Chenopods.

Leptotes marina Reakirt. A male in excellent condition was taken by S. R. Sims on *C. nauseosus* flowers at the Donner Lake overlook on the Norden-Truckee road, 28 September 1973. This blue also occurs at low elevations on both sides of the Sierra. It is, however, very local in the Sacramento Valley as compared with the Great Basin and seems much more likely to have reached Donner Pass from the east than the west. A female *L. marina* was taken at Tahoe City, 18 miles south of the Pass at the same elevation, on 24 September 1974. Tahoe City has a very marked east-slope character.

Lycaena helloides Boisduval. The Purplish Copper is a fairly frequent capture in the mid-elevation Sierras. In 1973, three males were taken at Donner, on 17 August, 13 September, and 16 October. In 1974, single males were taken on 26 June and 24 July. The 16 October, 1973 specimen was taken on *C. nauseosus* flowers at the same spot where *B. exilis* was found the previous week. *L. helloides* is common in the lowlands on both

sides of the Sierran massif. Potential host plants (Polygonaceae) are numerous at Donner. On the west slope, *L. helloides* becomes sporadic above about 2500 feet, but in 1974 it was found breeding at Lang Crossing, Nevada County, at about 4600 feet. *Habrodais grunus* Boisduval. One female, 18 July 1973, on the Lake Mary road. This is characteristically a species of the upper foothills and through the Transition Zone, always associated with its host, *Quercus chrysolepis* Liebm. (Fagaceae). This tree is rarely seen above about 5000 feet at the latitude of Donner Pass and has never been observed in the Pass area. The specimen must have reached Donner from the west.

NYMPHALIDAE: *Limenitis bredowii californica* Butler. Emmel and Emmel (1974) report three females, 21 June 1970. Individuals (sex undetermined) were seen at Donner Pass on 11 July and 28 September 1973, and on 9 June, 24 July, and 16 October 1974. It thus appears that *L. b. californica* reaches Donner fairly frequently, but its breeding status is unknown. It is a very strong-flying species which is common to at least 5000 feet on the west slope.

Precis coenia Hubner. In 1972, this was seen only once at 7000 feet (Boreal Ridge). In 1973, specimens were seen or taken on 11 and 25 July, 17 August, 28 September, and 5 and 16 October at Donner. In 1974, it was not seen at Donner at all. Emmel and Emmel considered it common at Donner in 1960. Hosts (Scrophulariaceae, Plantaginaceae) are numerous and it seems very likely that it breeds in years when gravid females arrive before late summer. The Buckeye is abundant on the floors of the Sacramento Valley and Great Basin, and it breeds every year on the west slope to about 3000 feet.

HESPERIIDAE: *Hylephila phylaeus* Drury. Females: Soda Springs, 28 September 1973, and Norden, 5 October 1973, the latter on flowers of *C. nauseosus*. The Fiery Skipper is extremely abundant in the lowland Sacramento Valley, and locally so around Reno in the Great Basin. In 1972 it was taken once at 5000 feet on the west slope (female, 29 September). Immigration from the west seems more probable for this species.

Atalopedes campestris Boisduval. One of each sex taken at Norden, 24 July 1974. It seems very unlikely *a priori* that this lowland species breeds or overwinters at Donner Pass. It is common in the Sacramento Valley and unknown at Truckee.

Donner Pass may be an exceptionally good accumulator of altitudinal dispersers for topographic and meteorological reasons. The Pass is noted for its high winds throughout the year, which occur when barometric pressure is significantly higher on one side of the range than on the other and the denser air rushes through the Pass to displace the lighter air across it. The direction of this flow is more often from west to east than the reverse. In autumn, however, Canadian high pressure may build into the Great Basin and produce sustained easterly flow for several days.

Movements of *Nymphalis milberti*

In general, records of altitudinal dispersers are of lowland species at high elevations rather than the reverse. Similarly, in the eastern United States, many more butterflies appear to disperse northward than the reverse. The Tortoiseshells, genus *Nymphalis*, provide exceptions to this generalization. In the east, *N. milberti* Latreille and *N. j-album* Bdv. & LeC., while basically northern, undergo periodic range extensions which carry them far to the south of their permanent breeding grounds, and to lower elevations. This occurs on a much larger scale in the mass-migratory *N. californica* Bdv. (Shapiro, 1974a).

Nymphalis milberti is generally a rare insect in central California. Garth and Tilden (1963) report it from Transition Zone up to 13,090 feet in Yosemite. Transition Zone, the zone of yellow pine, incense cedar, and Douglas fir, has its lower limit around 3000 feet.

On 11 April 1973, a female *N. milberti* was taken at the Spenceville Recreation Area, Yuba County, at an elevation of about 1000 feet. It was found in a colony of the introduced nettle, *Urtica urens* L., at the edge of a picnic area in cottonwood-willow forest along Dry Creek.

On 6 April 1974, a female *N. milberti* was taken in North Sacramento, Sacramento County, at an elevation of about 20 feet. It was on flowers of wild radish, *Raphanus sativus* L., at the edge of riparian cottonwood forest with an extensive understory of *U. urens*; the native *U. holosericea* Nutt. is also present. With the *N. milberti* were several *Vanessa atalanta* L., and larvae of this species were found on the native nettle. It is noteworthy that in both lowland records of *N. milberti* the colony of *U. urens* was the only occurrence of this plant for many miles in all directions. The close association of two females with such plants suggests at least a significant possibility of breeding at low elevations in spring.

As a working hypothesis it may be proposed that *N. milberti*, like *N. californica*, may overwinter and rear a spring brood at low elevations, disperse upslope for summer breeding, and return to the lowlands in autumn. Because of its scarcity, this movement could easily escape notice in normal years.

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